

Matrix Exercises

Exercise A

Given the following matrices:

$$A = \begin{pmatrix} 2 & 1 \\ 3 & -1 \end{pmatrix} \quad B = \begin{pmatrix} -6 & 3 \\ 7 & 0 \end{pmatrix} \quad C = \begin{pmatrix} 1 \\ 2 \\ -1 \end{pmatrix} \quad D = \begin{pmatrix} 1 & 0 \\ 3 & 4 \\ -2 & 0 \end{pmatrix} \quad E = \begin{pmatrix} 2 & -2 & 3 \\ 1 & 9 & 0 \end{pmatrix}$$

Find the following, if they exist:

- | | | |
|------------|-------------|-----------------------------------|
| 1. $A + B$ | 2. $2B - A$ | 3. M , given that $2A - 3M = B$ |
| 4. AB | 5. BA | 6. CE |
| 7. EC | 8. DE | 9. ED |
| | | 10. A^2 |

Exercise B

Given the following matrices:

$$A = \begin{pmatrix} -3 & 4 \\ 7 & 1 \end{pmatrix} \quad B = \begin{pmatrix} 5 & -3 \\ 2 & 1 \end{pmatrix} \quad H = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix} \quad I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

Find the following:

- | | | |
|------------|------------|------------|
| 1. AB | 2. BA | 3. $A + B$ |
| 4. $A + H$ | 5. $B + H$ | 6. AI |
| 7. IA | 8. IB | 9. BI |
| | | 10. I^2 |

Additional Question:

What **general** things do you think you have learned in these two exercises?

More:

Find out (your Maths teacher will help!) how to answer the questions above using technology, specifically with **(a)** your GDC and **(b)** by using a spreadsheet

Exercise C

Find the inverses of the following matrices:

$$1. \begin{pmatrix} 3 & 1 \\ 4 & -1 \end{pmatrix} \quad 2. \begin{pmatrix} -0.5 & 1 \\ 1.5 & -1 \end{pmatrix} \quad 3. \begin{pmatrix} -5 & 9 \\ 7 & -1 \end{pmatrix}$$

4. Prove that the determinant of the matrix $\begin{pmatrix} 4 & -1 \\ -8 & 2 \end{pmatrix}$ is 0.

Any matrix whose determinant is 0 is called **singular**.

What can you say about the inverse of a singular matrix?

(What does your GDC do when you try to find the inverse of a singular matrix?)

Exercise D

Use the matrix methods above to solve the following simultaneous equations:

1. $3x + y = -4$
 $x - 9y = 64$

2. $2x + 3y = 37$
 $6x - y = -9$

3. $x + y = 10$
 $3y - x = 2$

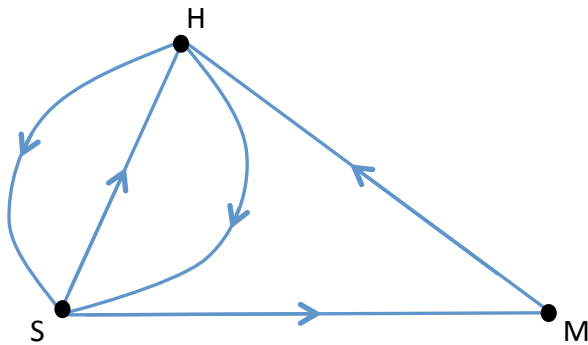
4. $2x + 5y = 4$
 $10x + y = 5.6$

5. What happens when you use the matrix method to try to solve:

$$\begin{aligned} 3x - 2y &= 15 \\ 9x - 6y &= 23 \end{aligned}$$

Exercise E

Here is a network of airline routes between Hong Kong, Manila and Singapore:

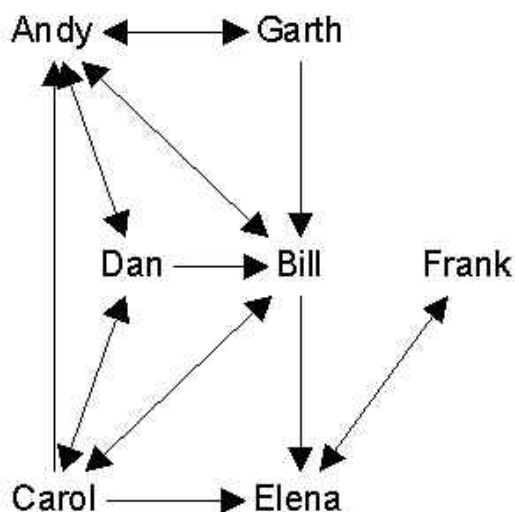


1. Find the adjacency matrix M for this network.

2. Calculate M^2

3. What do you think the physical significance of M^2 is?

4. Here is a diagram of a group of people. A two-way arrow indicates that both people like each other. A one-way arrow indicates that one person likes the other (in the direction of the arrow) but the feeling is not mutual.



Construct the adjacency matrix for this network

*(An interesting bit of vocabulary – in this graph, the people aren't called nodes; they're called **actors**)*